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CH2MHILL

February 15, 2002

Ms. Kristy Chew
Siting Project Manager
California Energy Commission
1516 Ninth Street, MS-15
Sacramento, CA 95814

RE: Data Responses, Set 2B
Cosumnes Power Plant (01-AFC-19)

On behalf of the Sacramento Municipal Utility District, please find attached 12 copies and one original of the Data Responses, Set 2B, in response to Staff's Data Requests dated January 4, 2002. Please note that there were some errors in the Data Responses 177 and 179 submitted as part of Set 2A. Therefore, the correct information is being resubmitted as part of this data response.

Please call me if you have any questions.

Sincerely,

CH2M HILL

John L. Carrier, J.D.
Principal Project Manager

c: Colin Taylor/SMUD
Kevin Hudson/SMUD
Steve Cohn/SMUD

COSUMNES POWER PLANT (01-AFC-19)

DATA RESPONSE, SET 2B

(Responses to Data Requests: 177 (revised), 179 (revised), 181, and 183)

Submitted by

SACRAMENTO MUNICIPAL UTILITY DISTRICT (SMUD)

February 15, 2002

CH2MHILL

2485 Natomas Park Drive, Suite 600
Sacramento, California 95833-2937

Technical Area: Air Quality
CEC Author: Tuan Ngo,P.E.
CPP Authors: Sierra Research

BACKGROUND

The initial commissioning of the project may cause emissions that exceed the limits that would be required during normal operation. The AFC (pages 8.1-38 to 40) discusses the potential emissions of the project during this period. The discussion, however, seems to indicate that the emissions from only one turbine were considered. Information was not provided as to an estimate of the duration (weeks or months) of the initial commissioning period and whether any mitigation is proposed. In addition, the Applicant should propose specific emission limits and duration of these limits for consideration as permit limits.

DATA REQUEST

177. Please provide a description of the length of each commissioning activity or phase identified in the commissioning sequence, and the estimated emissions associated with each activity.

Response: [Note: Errors were found in Table AQ-177 submitted in Data Response, Set 1A and in Attachment AQ-177a. For convenience, that data response is being resubmitted in its corrected form.]

The commissioning period is comprised of several equipment tests. These tests are briefly summarized below:

- **Full Speed No Load Tests (FSNL; no SCR)** - These tests will occur over approximately a 5-day period. The tests include a test of the gas turbine ignition system, a test to ensure that the gas turbine is synchronized with its electric generator, and a test of the gas turbine's over-speed system. During the tests, the heat input to the gas turbine will be approximately 400 MMBtu/hr, or 20% of the maximum heat input rating.
- **Part Load Tests (no SCR)** - These tests will occur over approximately a 6-day period. During these tests the gas turbine combustor will be tuned to minimize emissions and HRSG/steam line checks will be performed. During the tests, the heat input to the gas turbine will be approximately 1,120 MMBtu/hr, or 60% of the maximum heat input rating.
- **Full Load Tests (SCR Not Operational)** - These tests will occur over approximately a 4-day period. By the beginning of this test period, the gas turbine combustor will be completely tuned. Since the ammonia injection system will not be operated during this testing period, the SCR system will

not be operational. The test will include further checks on the HRSG and steam lines. During the tests, the heat input to the gas turbine will be approximately 1,865 MMBtu/hr, or 100% of the maximum heat input rating.

- **Full Load Tests (SCR Partial Operation)** - These tests will occur over approximately a 5-day period. During the test the ammonia injection system will be tuned to minimize NOx. During the tests, the heat input to the gas turbine will be approximately 1,865 MMBtu/hr, or 100% of the maximum heat input rating.
- **Full Load Tests (SCR Fully Operational)** - These tests will occur over approximately a 14-day period for each gas turbine/HRSG. By the beginning of this test period the SCR system will be completely tuned and achieving NOx control at design levels. During the tests, the heat input to the gas turbine will be approximately 1,865 MMBtu/hr, or 100% of the maximum heat input rating.

Enclosed as Attachment AQ-177a is an analysis of the emissions during the commissioning of the CPP project. The following table summarizes the maximum hourly, daily, and total emissions during the commissioning tests.

TABLE AQ-177
Emissions During Commissioning Period

	NOx	CO	VOC	SOx	PM_{10}
Maximum Hourly Emissions (lbs/hr)[1]	141.9	409.7	6.8	2.6	18.0
Maximum Daily Emissions (lbs/day)[1]	2,095	7,844	159	48	324
Total Emissions (lbs)[2]	36,390	115,023	2,674	880	7,344

Notes:
[1]Reflects one turbine in commissioning and one turbine in normal operation (normal operation includes 4 hours of startup/shutdown in one calendar day). Only one turbine will be commissioned at a time.
[2]Total emissions from commissioning operations for two turbines.

179. Please provide proposed language for consideration for permit conditions that would address hourly emission levels and/or emissions for specific commissioning events, and duration (hours, weeks or months) that these emission limits would be enforced.

Response: [Note: Errors were found in Attachment AQ-179a. For convenience, that data response is being resubmitted in its corrected form.]

Proposed conditions for the commissioning period have been adapted from BAAQMD permits for the Calpine LMEC, DEC and MEC projects and are shown in Attachment AQ-179a. Similar conditions have already been incorporated into the CEC's conditions of certification for these projects.

Attachment AQ-177a

Emissions Calculations for Commissioning Period

Maximum Hourly and Daily Emissions During Commissioning Cosumnes Power Plant										
	Hourly Emissions					Daily Emissions				
Unit	NOx (lbs/hr)	CO (lbs/hr)	VOC (lbs/hr)	SOx (lbs/hr)	PM10 (lbs/hr)	NOx (lbs/day)	CO (lbs/day)	VOC (lbs/day)	SOx (lbs/day)	PM10 (lbs/day)
One Gas Turbine in FSNL Test	125.0	385.0	3.5	1.3	9.0	1,500	4,620	42	16	108
One Gas Turbine in Normal Operation	16.9	24.7	3.3	1.3	9.0	595	3,224	117	32	216
Total =	141.9	409.7	6.8	2.6	18.0	2,095	7,844	159	48	324

Total Emissions During Commissioning Tests Cosumnes Power Plant					
Unit	NOx (lbs)	CO (lbs)	VOC (lbs)	SOx (lbs)	PM10 (lbs)
Gas Turbine/HRSG #1	18,195	57,512	1,337	440	3,672
Gas Turbine/HRSG #2	18,195	57,512	1,337	440	3,672
Total =	36,390	115,023	2,674	880	7,344

Detailed Emission Calculations for Commissioning Period - Cosumnes Power Plant									
Unit	Commissioning Test	Days	Daily Operation (hrs/day)	GT Firing Rate (MMBtu/hr)	Pollutant	Emission Factor (lbs/MMBtu)	Hourly Emissions (lbs/hr)	Daily Emissions (lbs/day)	Total Emissions During Test (lbs)
Gas Turbine/HRSG #1	FSNL + Ign. Tests	5	12	400	NOx	0.3125	125.00	1,500.0	7,500.0
					CO		385.00	4,620.0	23,100.0
					VOC		3.50	42.0	210.0
					SOx	0.0007	0.28	3.4	17.0
					PM10		9.00	108.0	540.0
	Part Load Tests	6	12	1,120	NOx	0.0427	47.85	574.2	3,444.9
					CO		385.00	4,620.0	27,720.0
					VOC		3.50	42.0	252.0
					SOx	0.0007	0.80	9.5	57.3
					PM10		9.00	108.0	648.0
	Full Load Tests without SCR operational	4	12	1,865	NOx	0.0320	59.75	717.1	2,868.2
					CO	0.0130	24.25	290.9	1,163.8
					VOC	0.0017	3.17	38.0	152.2
					SOx	0.0007	1.32	15.9	63.6
					PM10		9.00	108.0	432.0
	Full Load Tests with SCR at partial control	5	12	1,865	NOx	0.0142	26.56	318.7	1,593.5
					CO	0.0130	24.25	290.9	1,454.7
					VOC	0.0017	3.17	38.0	190.2
					SOx	0.0007	1.32	15.9	79.4
					PM10		9.00	108.0	540.0
	Full Load Tests with SCR at full control	14	12	1,865	NOx	0.0089	16.60	199.2	2,788.5
					CO	0.0130	24.25	290.9	4,073.2
					VOC	0.0017	3.17	38.0	532.6
					SOx	0.0007	1.32	15.9	222.5
					PM10		9.00	108.0	1,512.0
Gas Turbine/HRSG #2	FSNL + Ign. Tests	5	12	400	NOx	0.3125	125.00	1,500.0	7,500.0
					CO		385.00	4,620.0	23,100.0
					VOC		3.50	42.0	210.0
					SOx	0.0007	0.28	3.4	17.0
					PM10		9.00	108.0	540.0
	Part Load Tests	6	12	1,120	NOx	0.0427	47.85	574.2	3,444.9
					CO		385.00	4,620.0	27,720.0
					VOC		3.50	42.0	252.0
					SOx	0.0007	0.80	9.5	57.3
					PM10		9.00	108.0	648.0
	Full Load Tests without SCR operational	4	12	1,865	NOx	0.0320	59.75	717.1	2,868.2
					CO	0.0130	24.25	290.9	1,163.8
					VOC	0.0017	3.17	38.0	152.2
					SOx	0.0007	1.32	15.9	63.6
					PM10		9.00	108.0	432.0
	Full Load Tests with SCR at partial control	5	12	1,865	NOx	0.0142	26.56	318.7	1,593.5
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					VOC	0.0017	3.17	38.0	532.6
					SOx	0.0007	1.32	15.9	222.5
					PM10		9.00	108.0	1,512.0

Notes:

1. Emission factors during FSNL and ignition tests
   NOx - based on information for a G.E. Model FA during FSNL (125 lbs/hr).
   CO - based on hourly emission rates used for Crockett Cogeneration plant commissioning period.
   VOC - based on hourly emission rates used in CPP AFC for gas turbine startups.
   SOx and PM10 - emission factors based on design levels shown in CPP AFC for gas turbines.

2. Emission factors during part load tests
   NOx - based on estimate for part load test tuning combustor (12 ppm @ O2).
   CO - based on hourly emission rate used for Crockett Cogeneration plant commissioning period.
   VOC - based on hourly emission rate used in CPP AFC for gas turbine startups.
   SOx and PM10 - emission factors based on design levels shown in CPP AFC for gas turbines.

3. Emission factors during full load tests without SCR operational
   NOx, CO, VOC - based on combustor operating in pre-mix mode (9 ppm NOx, 6 ppm CO and CO, 1.4 ppm for VOC).
   SOx and PM10 - emission factors based on design levels shown in CPP AFC for gas turbines.

4. Emission factors during full load tests with SCR partially operational
   NOx - based information with combustor operating in pre-mix mode and SCR controlling NOx to 4 ppm.
   CO, VOC - based on combustor operating in pre-mix mode (6 ppm CO, 1.4 ppm for VOC).
   SOx and PM10 - emission factors based on design levels shown in CPP AFC for gas turbines.

5. Emission factors during full load tests with SCR fully operational
   NOx, CO, VOC - based on combustor operating in pre-mix mode and SCR operational (2.5 ppm NOx, 6 ppm CO, 1.4 ppm for VOC).
   SOx and PM10 - emission factors based on design levels shown in CPP AFC for gas turbines.

Attachment AQ-179a

Sample Conditions for the Commissioning Period

1. The owner/operator of the Cosumnes Power Plant (CPP) shall minimize emissions of carbon monoxide and nitrogen oxides from the Gas Turbines and Heat Recovery Steam Generators (HRSGs), to the maximum extent possible during the commissioning period. Conditions 1 through 10 shall only apply during the commissioning period as defined above. Unless otherwise indicated, Conditions 13 through X shall apply after the commissioning period has ended.

2. At the earliest feasible opportunity in accordance with the recommendations of the equipment manufacturers and the construction contractor, the combustors of Gas Turbines and Heat Recovery Steam Generators shall be tuned to minimize the emissions of carbon monoxide and nitrogen oxides.

3. At the earliest feasible opportunity in accordance with the recommendations of the equipment manufacturers and the construction contractor, the SCR Systems shall be installed, adjusted, and operated to minimize the emissions of carbon monoxide and nitrogen oxides from Gas Turbines and Heat Recovery Steam Generators.

4. Coincident with the steady-state operation of the SCR Systems pursuant to conditions 3 and 8, the Gas Turbines and the HRSGs shall comply with the NOx and CO emission limitations specified in conditions X through X.

5. The owner/operator of the CPP shall submit a plan to SMAQMD and the CEC CPM at least four weeks prior to first firing of the Gas Turbines describing the procedures to be followed during the commissioning of the turbines, HRSGs, and steam turbine. The plan shall include a description of each commissioning activity, the anticipated duration of each activity in hours, and the purpose of the activity. The activities described shall include, but not be limited to, the tuning of the Dry Low-NOx combustors, the installation and operation of the SCR systems, the installation, calibration, and testing of the CO andNOx continuous emission monitors, and any activities requiring the firing of the Gas Turbines and HRSGs without abatement by their respective SCR Systems.

6. During the commissioning period, the owner/operator of the CPP shall demonstrate compliance with conditions 8 and 10 through the use of properly operated and

maintained continuous emission monitors and data recorders for the following parameters:

firing hours
fuel flow rates
stack gas nitrogen oxide emission concentrations
stack gas carbon monoxide emission concentrations
stack gas oxygen concentrations

The monitored parameters shall be recorded at least once every 15 minutes (excluding normal calibration periods or when the monitored source is not in operation) for the Gas Turbines and HRSGs. The owner/operator shall use SMAQMD-approved methods to calculate heat input rates, nitrogen dioxide mass emission rates, carbon monoxide mass emission rates, and NOx and CO emission concentrations, summarized for each clock hour and each calendar day. All records shall be retained on site for at least 5 years from the date of entry and made available to SMAQMD personnel upon request.

7. The SMAQMD -approved continuous monitors specified in condition 6 shall be installed, calibrated, and operational prior to first firing of each Gas Turbine/HRSG. After first firing of the turbines, the detection range of these continuous emission monitors shall be adjusted as necessary to accurately measure the resulting range of CO and NOx emission concentrations. The type, specifications, and location of these monitors shall be subject to SMAQMD review and approval.

8. The total number of firing hours of <u>each</u> Gas Turbine/HRSG without abatement of nitrogen oxide emissions by the SCR System shall not exceed 400 hours during the commissioning period. Such operation of the Gas Turbines/HRSGs without abatement shall be limited to discrete commissioning activities that can only be properly executed without the SCR system in place. Upon completion of these activities, the owner/operator shall provide written notice to SMAQMD and the unused balance of the 400 firing hours allocated for each Gas Turbine/HRSG without abatement shall expire.

9. The total mass emissions of nitrogen oxides, carbon monoxide, volatile organic compounds, PM_{10} and sulfur dioxide that are emitted by the Gas Turbines and Heat Recovery Steam Generators during the commissioning period shall accrue towards the annual emission limitations specified in condition X.

10. Combined pollutant mass emissions from the Gas Turbines and Heat Recovery Steam Generators shall not exceed the following limits during the commissioning period. These emission limits shall include emissions resulting from the start-up and shutdown of the Gas Turbines.

Pollutant	Daily Limit (lb/calendar day)	Hourly Limit (lb/hour)
NOx (as NO_2)	2,095	142
CO	7,844	410
VOC (as CH_4)	159	n/a
PM_{10}	324	n/a
SO_2	48	n/a

Note: Hourly limits for NOx and CO will be monitored using CEMS.

Technical Area: Hazardous Materials
CEC Author: Alvin Greenberg, Ph.D.
CPP Authors: Karen Parker

BACKGROUND

Hazardous materials will be delivered to the power plant during operations. In order to evaluate the potential for impacts in the surrounding community, staff must have information on the number of deliveries.

DATA REQUEST

BACKGROUND

An Offsite Consequent Analysis (OCA) for aqueous ammonia is necessary for staff to determine if additional mitigation is needed.

DATA REQUEST

181. Please provide the OCA for aqueous ammonia described in AFC Section 8.12.5.

Response: Based on preliminary modeling, the design drawings provided in Data Response, Set 2A will not provide adequate protection from off-site consequences due to an ammonia tank rupture. Therefore, further design is being performed and the OCA will be provided on March 1, 2002.

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Technical Area: Waste Management
CEC Author: Alvin Greenberg, Ph.D.
CPP Authors: Karen Parker

BACKGROUND

The Phase I Environmental Site Assessment (ESA) that was prepared by SMUD is not complete for the 30-acre site or the 26-mile gas pipeline. Additionally, the Phase I ESA that was prepared states that 1993 ASTM guidelines were followed while the most recent standards are July 2000.

DATA REQUEST

183. Please provide a complete Phase I ESA for the 30-acre site, laydown areas, and 26-mile gas pipeline corridor according to ASTM 2000 guidelines.

Response: As stated in our letter filed January 11, 2002, SMUD objects to this Data Request as an unnecessary project expense. However, based on discussions at the Data Response Workshop held on January 25, 2002, it is SMUD's understanding that the CEC staff is satisfied with information furnished in the AFC for the 26-mile gas line. In addition, SMUD agrees to provide a Phase I ESA for the 30-acre plant site. It is anticipated that the Phase I ESA will be ready by March 15, 2002.